REMARKS

Claims 1-51 have been canceled.

Claims 52-97 have been added.

Rejections under 35 U.S.C. § 112

Claims 36, 39, 40, 46, 49 and 50 previously in this application

1. Claims 36, 39, 40, 46, 49 and 50 previously in this application were rejected under 35 U.S.C. § 112 as containing new subject matter not described in the specification and being filed by preliminary amendment on 08/03/04 after the filing date of the first executed Oath and Declaration. The Examiner is referred to newly submitted claim 112 above.

2. Referring to paragraphs 0001, 0037, 0042, 0044, 0083 and 0084 in the specification and particularly paragraph 0044, the use of the present invention in a variety of applications is specified and clearly contemplated. Specifically, in paragraph 0044, see ""...For example, the processor (104) may be an integrated circuit, a memory, a microprocessor, an opto-electric processor, an application specific integrated circuit (ASIC), a field programmable gate array (FPGA), an optical device, etc., or a combination of the foregoing processors."

3. Applicant has defined the term "processor" broadly in the specification so as to cover the application of the invention broadly and for use with heat-generating components in electronic systems.

4. Referring to newly submitted claim 97, applicant submits that this claim is allowable over the stated 35 U.S.C. § 112 rejection.

Rejections under 35 U.S.C. § 102(b)

Claims 1-13, 15-17, 19-34, 38, 41-44, 48, and 51 previously in this application

5. Claims 1-13, 15-17, 19-34, 38, 41-44, 48, and 51 previously in this application were rejected under 35 U.S.C. § 102(a) as being clearly anticipated by US/5,731,954 to Cheon (hereafter Cheon '954).

Apparatus Claims 1-13, 15-17, 19, 25, 26, 28-34, 38, 42-44, and 48 previously in this application

6. Referring to newly submitted independent claims 52, 55, 68, 75, 77, 81, and 85, above and all other newly submitted claims dependent there on, a liquid cooling system is claimed having no reservoir.

7. Cheon '954 clearly includes a reservoir (48) and labels it as such. The present invention includes no reservoir and this is significant. Referring to the specification (see in particular, paragraph 0023 and Figure 3), the heat exchanger is described primarily as an input cavity for receiving the heated liquid and distributing it to the various liquid paths through the dissipater; a dissipated for extracting heat from the liquid and cooling it; and an output cavity for receiving or collecting the cooled liquid from the dissipater and directing it to the system. Additional features and embodiments are also described such as a pump, impeller, motor, drive shaft and fans

8. The elimination of the reservoir is significant. Reservoirs require more coolant for the system; inhibit flow rates of the coolant through the system and thereby reduce real cooling capacity; require more power to operate; and create a substantial, additional risk of leakage. Furthermore, reservoirs will impede and deteriorate the convective circulation (and cooling effect) of a liquid cooling system, particularly after system shutdown, as they create more resistance to liquid flow and actual cooling after shutdown, when it is desirable to continue to cool the heat-generating component. Therefore, for the reasons stated above, these claims are allowable over the cited art.

9. Referring now to newly submitted independent claims 53, 56, 76, 78, 82 and 86 above and all other newly submitted claims dependent there on, a liquid cooling system is claimed having a self-contained heat exchanger.

10. Cheon '954 depicts a liquid cooling system in which the heat exchange system is comprised of several parts.[Contrary to the assertion made by the examiner, Cheon '954 describes item (42) as a radiator and not as a complete heat exchanger.] For example, Cheon '954 clearly depicts the heat exchange system having a reservoir (48), a peltier effect cooling module (46), a radiator (42) and a motor (M). In Figure 1 of Cheon'954 and from the specification there for, the motor (M) is depicted as being inside the computer or system housing (7) while the radiator (42), and possibly other components, outside the housing. This structure will require a complicated installation and assembly to the system housing. Additionally, it will add thermal resistance to cooling effectiveness of the heat exchanger since heat must be absorbed by the fins (54) and transmitted through the casing wall (50) of the reservoir (48), the peltier effect module (46) and finally to the radiator (42).

11. Cheon '954 does not show or teach a heat exchanger anything like the heat exchanger of the present invention. Referring to Figure 3 of the application, Cheon '954 does not show an output cavity. The "output cavity (60)" referred to by the examiner are described in Cheon '954 as the "downstream portion of reservoir (48)." In the present invention, a plurality of liquid paths through the dissipater are shown with an output cavity for collecting the cooled liquid from the various paths and directing it back into the cooling system.

12. In Cheon '954, there is no liquid flow through the radiator (42). Pump (P) is not self-priming and is not shaft driven; it merely rotates on a shaft used as an axle and not as a drive shaft. Cheon '954 does not show a liquid cooling system in a system housing (see Column 4, line 39; "…radiator (42) mounted on the outside of the computer housing (7)").

13. The liquid cooling system of the present invention is comprised of two pieces (excluding liquid conduits or the like, if used,); a heat transfer unit and a (self-contained) heat exchanger. The heat exchange unit is complete and stand-alone, with no reservoir. A motor, drive shaft and pump are also within this self contained unit. It is installed quickly with a several quick-connect fasteners within the system (e.g. computer) housing as part of the assembly line. This provides increased structural integrity, far greater protection against possible coolant leaks and significant cost savings during assembly. For certain applications, the heat transfer unit and the heat

exchanger can even be combined into a single unit. Therefore, for the reasons stated above, these claims are allowable over the cited art.

Claims 8-10, 13, 29-31 previously in this application

14. These claims formerly in the application relate to a pump and related apparatus for the forced circulation used in the present invention. These claims were rejected under 35 U.S.C. § 102(a) as being clearly anticipated by Cheon '954. In particular and referring to Cheon '954, the rejection states "… to the heat exchange unit (42), a motor (M-1) driven, self-priming pump (50) having an impeller (82) with curved blades, said impeller (82) is driven by said motor (M-1) via a shaft (88), …wherein said pump (50) and said impeller (82) are disposed inside said output cavity (60) for transporting a coolant (C)." [Please note that the pump is referred to in Cheon '954 as pump (P) and not item (50).]

15. As explained above in Cheon '954, a radiator is designated as element (42). The reservoir (48) is described as having an upstream portion (58) and a downstream portion (60). Cheon '954 does not teach an output cavity for receiving cooled liquid from all paths through the dissipater. In Cheon '954, the liquid does not pass through or even come near the radiator (42). The pump in Cheon '954 is not self-priming. It is not shaft driven either, but rather spins on an axis. Since Cheon '954 does not have an output cavity (but rather a down stream portion (60)), it does not teach or imply the output cavity of the present invention or its function.

16. Cheon '954, consequently, does not teach the disposition of the pump (P) in an output cavity. In Cheon '954, the pump (P) is described as being adjacent to the outlet (56). As explained in greater detail below, Cheon '954 cannot teach the disposition of a pump in an output cavity or at the lowest possible point in the heat exchanger as shown in Figure 3 of the specification. (Also see paragraphs 0017 and 0072 in the specification.) Similarly, Cheon '954 does not teach or imply a seal-less impeller as in enabled by applicants invention and specifically by having the shaft disposed from the motor through the input cavity, through a liquid-bearing tube through the dissipater and finally through the output cavity to the pump.

(See paragraphs 0069 and 0076 in the specification.) This disposition permits applicant's invention to operate without a seal for the impeller.

17. Referring now to newly submitted independent claim 59 and dependent (there on) claims 60-65, a heat exchanger in a liquid cooling system is described, comprising a dissipater for receiving heated liquid and cooling the liquid; an output cavity for receiving the cooled liquid from the dissipater and transporting the cooled liquid to the system; and a pump in the output cavity wherein the liquid is transported in response to operating the pump. For the reasons stated above, particularly with respect to paragraphs 14-16, these claims are allowable over the cited art.

Claims 15 and 42 previously in this application

18. These claims formerly in the application relate to apparatus for performing convective circulation, alone or in combination with forced circulation, in the heat transfer unit. These claims were rejected on the basis of Cheon '954 "…said heat transfer (contact) unit (30) having an inlet (34) positioned below an outlet (36), ….".

19. In Cheon '954, no mention is made whatsoever of convective circulation and no reference is made to the placement of the inlet vs. outlet in the heat transfer (contact) unit (30). Figure 1 can not be relied upon for accurately depicting the physical location of the inlet (34) or the outlet (36).

20. Figure 2 of Cheon '954 is in the nature of a schematic diagram and cannot be relied upon for physical placement of the devices. The examiner points to inlet (34) positioned above outlet (36) unit (30) in Figure 2. However the other heat transfer (contact) unit (12) in Figure 2 clearly shows inlet (18) and outlet (20) at the same height.

21. In Figure 4 of Cheon, the only drawing that seems to depict location and positioning, the inlet and the outlet of heat transfer (contact) unit (30) are clearly shown to be at the same vertical height.

22. Accordingly, Cheon '954 does not teach nor even contemplate the positioning of the inlet and outlet of the heat transfer unit for convective cooling.

23. Referring now to newly submitted independent claim 68, a liquid cooling system having no reservoir and a heat transfer unit with the inlet below the outlet (for convective circulation) is claimed. Therefore, for the reasons stated above in paragraphs 6-8 and 18-22, this claim is allowable over the cited art.

24. Referring now to newly submitted independent claim 69, a liquid cooling system having a self-contained heat exchanger and a heat transfer unit with the inlet below the outlet (for convective circulation) is claimed. Therefore, for the reasons stated above in paragraphs 10-13 and 18-22, this claim is allowable over the cited art.

Claim 16 previously in this application

25. This claim previously in the application relates to apparatus for performing convective circulation, alone or in combination with forced circulation, in the heat transfer unit. These claims were rejected on the basis of Cheon '954 "…wherein said heat exchange unit (42) having an input cavity (58).....and an output cavity (60) … positioned below the input cavity (58) ….".

26. As stated above in paragraph 15, in the Cheon '954 specification there is no mention of convective circulation and Cheon '954 does not teach nor even contemplate convective circulation. Referring to Figure 4, it would appear that the inlet opening (54) of reservoir (48) is disposed above outlet opening (56) of reservoir (48). However, if the system in Cheon '954 were designed for convective circulation, applicant suggests that conduit (74) with cooled liquid would never be situated so as to be at a higher elevation than conduit (72) with heated liquid. In Figure 4 of Cheon '954, conduits (72) and (74) are shown as crossing each other in elevation.

27. Referring now to newly submitted dependent claim 72 , a liquid cooling system for cooling heat-generating components in an electronic system having no reservoir and a heat exchanger with an input cavity disposed above a dissipater and an output cavity disposed below the dissipater is claimed and a liquid cooling system for cooling heat-generating components in an electronic system having a self-contained heat exchanger with an input cavity disposed above a dissipater and an output cavity disposed below the dissipater is claimed. Therefore, for the reasons stated above in paragraphs 6-8 and 25-26, this claim is allowable over the cited art.

Method Claims 20-24, 27, 41, and 51 previously in this application

28. These claims previously in the application were rejected under 35 U.S.C. §102(a) as inherently necessitated by the device structure as taught by Cheon '954. Claims 20-24, 27, 41 and 51 previously in the application all relate convective circulation, alone or in combination with forced circulation. For the reasons provided above in paragraphs 19 - 22, Cheon '954 does not teach nor contemplate convective circulation, alone or in combination with forced circulation, the methods claimed in claims 20-24, 27, 41 and 51 and cannot be "necessitated by the device structure of Cheon '954".

29. Referring to newly submitted independent claims 75 and 77 and any dependent claims there on, methods are claimed for performing forced circulation in a liquid cooling system for cooling heat-generating components in an electronic system. Claim 75 is a method claim for a cooling system having no reservoir and the steps of receiving heated liquid at a heat exchanger; cooling the liquid within the heat exchanger for transporting to a heat transfer unit; receiving the cooled liquid at the heat transfer unit; and heating the liquid within the heat transfer unit from heat transferred from the heat generating component(s) for transportation to the heat exchanger. Claim 77 is a method claim for a cooling system having no reservoir and a heat exchanger and the steps of receiving heated liquid at an input cavity of the heat exchanger for distribution to a dissipater; cooling the liquid in the dissipater; and receiving the cooled liquid from the dissipater at an output cavity for directing the cooled liquid to the system. For the reasons stated in paragraphs 6-8 above, these claims are allowable over the cited art.

30. Referring to newly submitted independent claims 76 and 78 and any dependent claims there on, methods are claimed for performing forced circulation in a liquid cooling system for cooling heat-generating components in an electronic system. Claim 76 is a method claim for a cooling system having a self-contained heat exchanger and the steps of receiving heated liquid at the heat exchanger; cooling the liquid within the heat exchanger for transporting to a heat transfer unit; receiving the cooled liquid at the heat transfer unit; and heating the liquid within the heat transfer unit from heat transferred from the heat generating component(s) for

transportation to the heat exchanger. Claim 78 is a method claim for a cooling system having a self-contained heat exchanger and the steps of receiving heated liquid at an input cavity of the heat exchanger for distribution to a dissipater; cooling the liquid in the dissipater; and receiving the cooled liquid from the dissipater at an output cavity for directing the cooled liquid to the system. For the reasons stated in paragraphs 9-13 above, these claims are allowable over the cited art.

31. Referring to newly submitted independent claims 81 and 82 and any dependent claims there on, methods are claimed for performing convective circulation in a heat transfer unit coupled to heat-generating component(s) of a liquid cooling system having no reservoir and the steps of positioning an outlet for heated liquid above an inlet for cooled liquid and for performing convective circulation in a heat transfer unit coupled to heat-generating component(s) of a liquid cooling system having a self-contained heat exchanger and the steps of positioning an outlet for heated liquid above an inlet for cooled liquid For the reasons stated in paragraphs 6–8 and 9-13 above, these claims are allowable over the cited art.

32. Referring to newly submitted dependent claim 84, a method is claimed for performing convective circulation in the method of claim 77 comprising the steps of positioning the input cavity above the dissipater and an output cavity below the dissipater and for performing convective circulation in the method of claim 78 comprising the steps of positioning the input cavity above the dissipater and an output cavity below the dissipater. For the reasons stated in paragraphs 6-8 and 9-13 above, these claims are allowable over the cited art.

33. Referring to newly submitted independent claims 85 and 86 and any dependent claims there on, methods are claimed for performing a combination of convective circulation (by disposing inlets and outlets for cooler liquid below inlets and outlets for heated liquid) and forced circulation (by a pump) in a liquid cooling system for cooling heat-generating components in an electronic system having no reservoir and for performing a combination of convective circulation (by disposing inlets and outlets for cooler liquid below inlets and outlets for heated liquid) and forced circulation (by a pump) in a liquid cooling system for cooling heat-generating components in an electronic system having a self-contained heat exchanger. For the reasons stated in paragraphs 6-8 and 9-13 above, these claims are allowable over the cited art.

Rejections under 35 U.S.C. § 103(a)

34. Claims 14, 18, 35-37, 40, 45-47, and 50 previously in this application were rejected as obvious under 35 U.S.C. § 103(a).

Claims 35-37, 40, 45-47, and 50 previously in this application

35. Referring to newly submitted dependent claims 92-97; these claims are now dependent on independent claims which applicant believes are allowable and therefore these new claims should thus also be allowable.

Claim 14 previously in this application

36. This claim was rejected on the basis of Cheon '954 in combination with either US/5,323,847 to Koizumi et al or US/6,313,990 to Cheon.

37. Cheon '954 does not teach the use of a fan. Cheon '990 and Koizumi '847 do not teach expelling the air from the electronic housing system to keep it cooler and do not teach the implementation of non-laminar air flows (in the specification, see paragraphs 0068 and 0070).

38. Referring to newly submitted dependent claims 66 and 67 and newly submitted dependent method claim 80, these claims are now dependent on independent claims which applicant believes are allowable and therefore these new claims should thus also be allowable.

Claim 18 previously in this application

39. Claim 18 previously in this application was rejected under 35 U.S.C. § 103(a) "...as being unpatentable over Cheon '954 taken with US/4,610,222 to Goddard et al (Goddard '222). Cheon ('954) disclosed all and further that said coolant (C) is an automotive radiator fluid (column 5, lines 46+), but did not disclose that said coolant is a propylene glycol based coolant.

Goddard disclosed an automotive radiator fluid, which contains a propylene glycol additive in order to inhibit oxidation and corrosion (column 4, lines 50-58). Since inventions of Cheon ('954) and of Goddard are from the same field of endeavor (liquid cooling systems), the purpose of the propylene glycol additive disclosed by Goddard would be recognized in the invention of Cheon ('954). It would have been obvious to a person of ordinary skill in the cooling art at the time the invention was made to provide said coolant (C) of Cheon ('954) with the propylene glycol additive as taught by Goddard in order to inhibit oxidation and corrosion of the components in the Cheon '954 cooling system." The rejection is respectfully traversed.

40. In *ex parte* examination of patent applications, the Patent Office bears the burden of establishing a *prima facie* case of obviousness. MPEP § 2142; *In re Fritch*, 972 F.2d 1260, 1262, 23 U.S.P.Q.2d 1780, 1783 (Fed. Cir. 1992). The initial burden of establishing a *prima facie* basis to deny patentability to a claimed invention is always upon the Patent Office. MPEP § 2142; *In re Oetiker*, 977 F.2d 1443, 1445, 24 U.S.P.Q.2d 1443, 1444 (Fed. Cir. 1992); *In re Piasecki*, 745 F.2d 1468, 1472, 223 U.S.P.Q. 785, 788 (Fed. Cir. 1984). Only when a *prima facie* case of obviousness is established does the burden shift to the applicant to produce evidence of nonobviousness. MPEP § 2142; *In re Oetiker*, 977 F.2d 1443, 1445, 24 U.S.P.Q.2d 1443, 1444 (Fed. Cir. 1992); *In re Rijckaert*, 9 F.3d 1531, 1532, 28 U.S.P.Q.2d 1955, 1956 (Fed. Cir. 1993). If the Patent Office does not produce a *prima facie* case of unpatentability, then without more the applicant is entitled to grant of a patent. *In re Oetiker*, 977 F.2d 1443, 1445, 24 U.S.P.Q.2d 1443, 1444 (Fed. Cir. 1992); *In re Grabiak*, 769 F.2d 729, 733, 226 U.S.P.Q. 870, 873 (Fed. Cir. 1985).

41. A *prima facie* case of obviousness is established when the teachings of the prior art itself suggest the claimed subject matter to a person of ordinary skill in the art. *In re Bell*, 991 F.2d 781, 783, 26 U.S.P.Q.2d 1529, 1531 (Fed. Cir. 1993). To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to

make the claimed invention and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. MPEP § 2142.

42. Cheon '954 taken alone or in combination with Goddard '22 does not teach or suggest the use of propylene glycol as a (coolant) base in a liquid cooling system for cooling heat-generating components in an electronic system.

43. Goddard teaches using propylene glycol as an additive, not as a base, in an internal combustion engine. Moreover, coolants used for internal combustion engines are not necessarily relevant in cooling heat-generating components in an electronic system. In the latter, one is looking for thermal transfer characteristics at least as much as prevention against rust and oxidation. For thermal transfer capability, one would ordinarily not think of propylene glycol. However, when used as a base and combined with water (and other additives if desired), a surprisingly excellent thermal transfer coefficient is achieved. Protection against rusting and oxidation is also achieved. Finally, protection against evaporation is further achieved.

44. Cheon '954 suggests a radiator fluid, water or some other liquid capable of transferring heat for the coolant (C) and cannot be argued to teach, imply or suggest in any way the use of propylene glycol as a base for the liquid coolant. Taken with Goddard '222, which teaches propylene glycol as an additive, does not provide one skilled in the art of liquid cooling systems for cooling heat-generating components in electronic systems with even an implication of using propylene glycol as a base.

45. Referring now to newly submitted independent claim 73 and newly submitted independent method claim 90 and all dependent claims there on, applicant submits that the rejection of claim 18 previously in this application is traversed and that the newly submitted claims are allowable.

Conclusion

As a result of the foregoing, the Applicant asserts that Claims 52 through 97 are in condition for allowance, and respectfully requests an early allowance of such Claims.

Should the Examiner have any further comments or issues or if the Examiner has any suggestions for expediting allowance of this Application, the Applicant respectfully invites the Examiner to contact the undersigned at the telephone number indicated below or at ***artfisher@sbcglobal.net***.

Respectfully submitted,

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